A DAY AT A HAT-FACTORY.

[The Hat-Battery, or 'Kettle,' with Men employed in Wetting, Rolling, Pressing, 'Ruffing,' and Blocking the Hat-Bodies.]

THE early history of our manufactures frequently excites a smile at the quaint and energetic manner in which some of the old writers denounce the fashions of their times; but while we are often disposed to agree with them in ridiculing the strange forms of dress which have been adopted at different periods, we must withhold our assent to the principles of their commercial economy, which are often short-sighted in the extreme.

Philip Stubbs, a writer of the Elizabethan age, published, in 1585, his 'Anatomie of Abuses,' in which, among other things, the costume of the time is made the subject of censure. After anatomizing ladies' dresses, and discoursing on the iniquities of ruffs and furbelows, he visits the wardrobes of the other sex for a similar purpose, and thus speaks of the then fashionable hats:—"Sometimes they use them sharp on the crown, peaking up like the spear or shaft of a steeple, standing a quarter of a yard above the crown of their heads, some more, some less, as please the fancies of their inconstant minds. Some others are flat and broad on the crown, like the battlements of a house. Another sort have round crowns, sometimes with one kind of band, sometimes with another, now black, now white, now russet, now red, now green, now yellow; now this, now that, never content with one colour or fashion two days to an end. And thus in vanity they spend the Lord's treasure, consuming their golden years and silver days in wickedness and sin." But the material pleases him as little as the form and colour:—"And as the fashions be rare and strange, so is the stuff whereof their hats be made divers also; for some are of silk, some of velvet, some of taffetie, some of sarcenet, some of wool; and, which is more curious, some of a certain kind of fine hair. These they call *Bever Hats*, of twenty, thirty, or forty shillings price, fetched from beyond the seas, from whence a great sort of other vanities do come beside."

What would be the surprise of Philip Stubbs, if he could now witness the extent to which the "vanity" of "Bever Hats" influences the commercial arrangements of England;—the importation of beaver and musquash furs from North America, of neutria furs from South America, of wools from various parts of Continental Europe, of gums, resins, and dyes from almost every part of the globe! If he found, too, that one single firm gives employment to fifteen hundred persons in making hats of various kinds, and that the value of all the hats made in Great Britain in one year is probably not much less than three millions sterling, he would perhaps cease to include "beaver hats" in his list of abuses.

To mark the advance of the world in this respect, since the time of Stubbs, we propose to consider the present state of the hat manufacture. With this object in view, we have visited an establishment where the processes are conducted on a very complete and extensive scale; and we will suppose the reader to be accompanying us through the various departments of that establishment.

The hat-factory of Messrs. Christy occupies two extensive ranges of buildings on opposite sides of Bermondsey Street, Southwark. These we will term the east and west ranges, each of which is approached by a

gateway leading from the street. On entering the gateway to the east range, the first object seen at the end of a long avenue is a lofty chimney connected with a steam-engine, and rising to the height of one hundred and sixty feet. Over the gateway is a range of warehouses for wool and other articles; and from thence, proceeding onwards, is seen on the left a pile of buildings, occupied by cloth cap makers, hat trimmers, and packers. On the right of the same avenue is another range of buildings, consisting of a fire-proof varnish store-room, silk-hat workshops, and shops wherein the early stages of beaver hatting are carried on. At the left of the great chimney is a building wherein common black glazed or japanned hats are made; and near it is an archway leading northward to another avenue surrounded by buildings. These consist of a turner's shop, where blocks for shaping hats are made; a shell-lac store, where the lac is bruised, ground, and prepared for use; a blacksmith's shop, for the repair of iron-work used in various parts of the factory; a saw-mill and sawing-room, where machine-worked saws cut up timbers into boards for packing-cases required in the export department; a logwood warehouse, wherein a powerful machine cuts the logs into fine shreds; a fur-room, in which the beaver and other furs are cut from the skins by machinery; rooms wherein the coarse hairs are pulled from the skins; the steam-engine, with its boiler, furnace, &c.; a carding-room, for disentangling the locks and fibres of wool; a blowing-room, for separating two qualities of beaver-fur, or hair; together with various warehouses, storerooms, carpenters' shops, timber-yard, &c. This brings us to the northern extremity of the range; on returning from which we pass wool-warehouses and sorting-rooms, wool and fur washing-houses, stoving-rooms, fur-hat workshops, 'picking' rooms, clerk's offices, &c.

Crossing Bermondsey Street to the western range, we find a beaver store-room, the dye-house, stoving-rooms, shaping and finishing rooms, &c.; the whole being, however, much less extensive than the east range.

It may excite surprise to hear of saw-mills, blacksmiths', turners', and carpenters' shops on the premises of a hat-maker; but this is only one among many instances which might be adduced, in the economy of English manufactures, of centralization, combined with division of labour, within the walls of one factory.

The nature of the operations carried on in the greater number of these buildings will perhaps be best explained by tracing the history of a beaver hat from the time when the crude materials enter the factory, till the hat, in a finished state, is warehoused.

If a dozen individuals to whom the subject is new were asked, "How is a beaver hat made?" it is not improbable that we should receive a dozen different answers. One would think it is cast in a mould; another, that the beaver's fur, skin and all, is stiffened and shaped; a third, that the fur is in some way woven into a kind of cloth, and put on a stiff foundation; but perhaps not one would have an idea of the beautiful process of *felting*, which is the groundwork of the whole theory of hat-making. A beaver hat consists mainly of two parts,—the *body* and the *covering;* the former of which is made of fine wool and coarse fur, mixed, felted, stiffened, and shaped; and the latter of beaver fur, made to adhere to the body by the process of felting. Wool and fur constitute therefore the main ingredients employed. For hats of inferior quality, coarse wool is employed for the body, and coarser fur, or sometimes fine wool, for the covering.

The wool is brought to the factory in a dirty and greasy state, retaining much of the moisture derived from the animal. It is carried to a large washing-house, on a level with the ground, where the steam rising from immense boilers and tubs indicates the great scale on which the process is conducted. The wool is soaked and washed, until the greasiness is removed, and is then subjected to the action of a screw-press, whereby all the water is expelled, and the wool left in a clean state. From the washing-house the wool is conveyed to a drying-room; and, when required for use, it undergoes the process of *carding* in the carding-room. In a former number (No. 498) we had occasion to explain the action of a carding-engine in the cotton manufacture; and we need say no more of it here, than that such an engine, worked by the same steam-engine which sets so many other parts of the working apparatus in motion, combs out the fibres of wool, and presents them in a light and tolerably disentangled state. The wool is then ready for the hatter; and we will trace the preparation of the fur up to the same point.

The term *fur*, in a general sense, refers to the hairy coating of such animals as the beaver, bear, marten, minx, hare, and rabbit. The skins of these animals, when merely dried after being stripped from the body, are called *peltry;* when the skin of the inner side has been converted into a sort of leather, by a peculiar process of tanning, the skins obtain the name of *furs*, in a restricted sense; and the term is still more restricted when applied to the hairy coating cut from the skin, and presented in the form of delicate filaments.

Now it is in the last-named form that fur is useful to the hatter; and the furs to which he gives the preference are those of the beaver, the musquash, the neutria, the hare, and the rabbit, of which the first is by far the most valuable. The beaver inhabits the districts of North-West America, where its peculiar habits of life have given rise to many marvellous tales, the truth of which is now more than doubted. (See vol. ii., p. 129.) The romantic details often presented in the lives of beaver-hunters, as well as the mode of dealing between them and the fur-dealers, have been described in two articles on the Canadian fur-trade (Nos. 375, 376), and need not, therefore, be dwelt on here. The skins, as received at the factory from the Hudson's Bay Company, are tolerably flat and stiff, measuring, generally, about three feet by two. The hairy surface is of a brownish colour, but is not that to which the hatter attaches value; for this animal has two kinds of hair on its skin, the innermost of which is short, implicated, and as fine as down, and the outermost thicker, longer, and more sparing. Of the separation of these two kinds we shall speak presently.

Neutria is the fur of a small animal called the *coypou*, the *quoiya*, or the *Myopotamus Bonariensis*, found in various parts of South America. The long or coarse hairs are generally of a reddish colour; and the inner or soft hairs, brownish ash colour. It was not until about thirty years ago that hatters, influenced by the high price of beaver fur (which within a century has risen from 20*s.* to 80*s.* per pound), began to use neutria fur; but since that time the employment of them has become so extensive, that one million neutria skins have sometimes been imported in one year. This animal is yet little known to naturalists, but certain peculiarities in the skin beneath the fur have led to much conjecture among those who have frequent opportunities of inspecting the skins, concerning the structure and habits of the animal: for these points we refer to the article in No. 243, vol. v., p. 20.

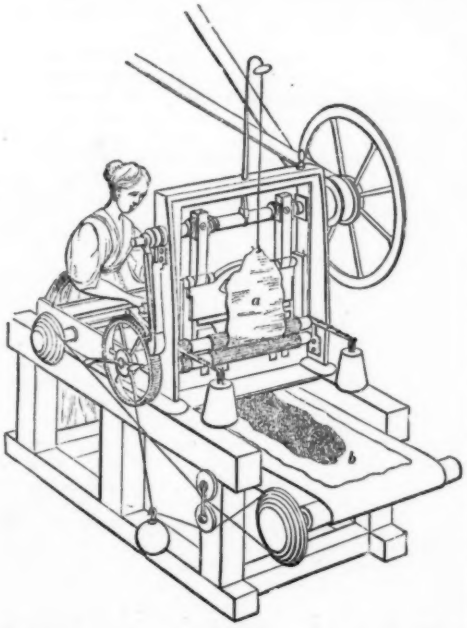
The *Musquash*, or *Mus Zibethicus*, is a North American animal, about the size of the common rabbit, and covered, like the beaver and the coypou, with two kinds of hair or fur, having different degrees of fine-

ness. The name *musk rat* is sometimes given to this animal, on account of its secretion of a peculiar fluid having the odour of musk. (See No. 521.)

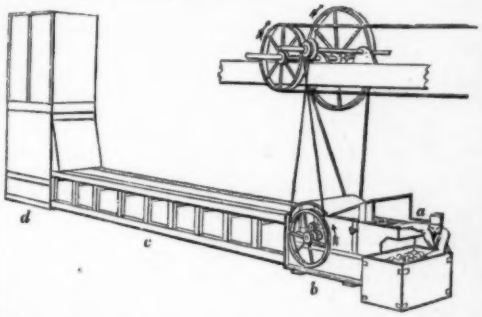
The fur of *hares* and *rabbits* is so well known as to render few words of description necessary. The rabbits fed on the wolds of Yorkshire are said to yield fur much exceeding in value that of the rabbits bred near London, by reason of the superior length and strength of the hairy filaments.

We have digressed a little, in order to show the nature of the furs employed by the hatter. The skins, or pelts, on being conveyed to the factory, are rather greasy and dirty, and are therefore cleansed with soap and water; this is effected in the same large washing-house where the wool is cleansed. When the pelts are dried and required for further processes, they are carried to the 'pulling-room,' where a number of women, seated on stools, are employed in pulling out the coarse outer hairs from the skins: these coarse hairs are utterly useless to the hatter, and, if preserved at all, are sold for stuffing cushions and such-like purposes. Each woman lays a pelt on her lap, or on a low bench, and, by means of a knife acting against the thumb, tears out the larger hairs, her fingers and thumb being guarded by a stout leather shield.

We next trace the progress of the pelt into a room where, to one unused to the din of machinery, everything seems noise and confusion. This is the 'cutting' or 'cropping' room, in which six or eight machines are actively at work, each attended by a female. We Englishmen, happily, know very little of the guillotine, or we should probably find some resemblance between its action and that of the cropping-machine. A long, broad, and sharp blade, having the edge downwards, works very rapidly, with a chopping action; and the pelt being introduced between the blade and a support beneath, the fur is cut from it with a precision that nothing can exceed. The impression on the mind of a visitor is that the pelt must inevitably be chopped to shreds, but, by some admirable adjustment of mechanism, the fur is removed without the skin being cut. The female who attends the machine puts it in or out of work when required, guides the pelt through it, collects the filaments of fur, &c. Such outer fragments or small pieces of the pelt as do not lose their fur by the action of the machine, are laid on a table, and women, by the aid of small instruments shaped somewhat like a cheese-cutter, remove the remaining fur. The denuded skins are useless to the hatter, and are sold at a small price to size-makers in the north of England.



[Cutting-Machine. *a*, the skin, passing between rollers, after the fur has been cut from it; *b*, the fur deposited in a light layer on an endless cloth.]



[Blowing-Engine. *a*, spot on which the fur is placed; *b*, box containing the revolving fan; *c*, hollow trunk through which the fur is blown; *d*, receptacle where the finer fur is deposited.]

We have said that the women in the 'pulling' room cut, tear, or pull out the long coarse hairs from the pelts, and that these hairs are useless to the hatter. But it is impossible completely to separate the coarse from the fine fur by this means; and, therefore, the fur, when cropped from the pelt by the machines, is conveyed to the 'blowing-room,' finally to effect the separation. This room is probably the largest in the factory, and presents a remarkable appearance. It is of small height, but measures, perhaps, fifty feet by forty, having eight hollow boxes or trunks extending nearly the whole length of the room. The action of these hollow machines is exceedingly beautiful, and may, perhaps, be understood without a minute detail of mechanism. A quantity of beaver or other fur is introduced at one end, near a compartment in which a vane or fly is revolving with a velocity of nearly two thousand rotations in a minute. We all know, even from the simple example of a lady's fan, that a body in motion gives rise to a wind or draught; and when the motion is so rapid as is here indicated, the current becomes very powerful. This current of air propels the fur along a hollow trunk to the other end of the machine, and, in so doing, produces an effect which is as remarkable as it is valuable. All the coarse and comparatively valueless fur is deposited on a cloth stretched along the trunk, while the more delicate filaments are blown to a receptacle at the other end. Nothing but a very ingenious arrangement of mechanism could produce a separation so complete as is here effected; but the principle of action is not difficult to understand. If there were no atmosphere, or if an enclosed place were exhausted of air, a guinea and a feather, however unequal in weight, would fall to the ground with equal velocity; but in ordinary circumstances, the guinea would obviously fall more quickly than the feather, because the resistance of the air bears a much larger ratio to the weight of the feather than to that of the guinea. As the resistance of air to a moving body acts more forcibly on a light than on a heavy substance, so likewise does air, when in motion, and acting as a moving force. When particles of sand and gravel are driven by the wind, the

lightest particles go to the greatest distance. So it is with the two kinds of fur in the 'blowing machine,' those fibres which are finest and lightest are driven to the remote end of the machine.

We have thus visited those parts of the factory in which the crude materials are prepared for the hatter, and will now, therefore, take our materials to the 'body-makers,' and witness the processes of forming them into a hat.

In one corner of the factory is a dark dingy room, where, around a steaming 'kettle,' we see six or eight men busily employed at some operation, the nature of which can scarcely be divined through the clouds of steam. We pass by them, however, and visit some upper rooms, where the fur and wool are worked up together. The 'body,' or 'foundation,' of a good beaver hat is now generally made of eight parts rabbits' fur, three parts Saxony wool, and one part of lama, vicunia, or 'red' wool. A sufficient quantity of these for one hat (about 2½ ounces) is weighed out and placed in the hands of the 'bower.' On entering the 'bowing-room,' a peculiar twanging noise indicates to the visitor that a stretched cord is in rapid vibration; and the management of this cord by the workman is seen to be one of the many operations in hatting wherein success depends exclusively on skilful manipulation. A bench extends along the front of the room beneath a range of windows, and each 'bower' has a little compartment appropriated to himself. The bow is an ashen staff, from five to seven feet in length, having a strong cord of catgut stretched over bridges at the two ends. The bow is suspended in the middle by a string from the ceiling, whereby it hangs nearly on a level with the work-bench, and the workman thus proceeds:—the wool and coarse fur, first separately and afterwards together, are laid on the bench, and the bower, grasping the staff of the bow with his left hand, and plucking the cord with his right by means of a small piece of wood, causes the cord to vibrate rapidly against the wool and fur. By repeating this process for a certain time, all the original clots or assemblages of filaments are perfectly opened and dilated, and the fibres, flying upwards when struck, are by the dexterity of the workman made to fall in nearly equable thickness on the bench, presenting a very light and soft layer of material. Simple as this operation appears to a stranger, years of practice are required for the attainment of proficiency in it.

The point in the routine of processes at which we have now arrived requires a brief consideration of the operation of felting, on which the whole manufacture of a beaver hat depends. Felting is a process whereby animal fibres are made to cohere and to form a kind of cloth, without the aid of weaving, plaiting, knitting, sewing, or any analogous processes—warmth, moisture, and friction being the means by which it is effected. There is reason to believe that the process of felting was known in early times, and that the tents of the Tartars, as well as some articles of clothing, were produced by these means; but the evidence on this point is rather indistinct. At what time felted wool was first employed for making hats it would be difficult now to say; but there is a legend current among some of the continental hatters which gives the honour to St. Clement, fourth bishop of Rome. Most fraternities love to have a patron saint, when they can find one; and those hatters who regard St. Clement in this light inform us that this holy man, being forced to flee from persecutors, found his feet to be so blistered by long-continued travel, that he was induced to put a little wool between his sandals and the soles of his feet. On continuing his journey, the warmth, moisture, motion, and pressure of the feet worked the wool into a uniformly compact substance. Finally, the wanderer, observing the useful nature of this substance, caused it to be introduced in the manufacture of various articles of apparel.

But leaving St. Clement and his felted 'inner soles,' we may remark that the philosophy of felting was not understood until the microscope was applied to the examination of animal fibres. It was then found that the fibre, whether of wool or fur, is surrounded by a vast number of minute teeth projecting obliquely from the central stem. As these teeth are very sharp and are turned in one direction, they present an obstacle to the motion of the fibre in that direction, but enable it to glide easily in the opposite one; just as an ear of barley, when placed stalk uppermost within the cuff of the coat-sleeve, will soon work its way up to the shoulder by the motion of the arm. In some woolly fibres the irregularities appear like concentric cups, rather than sharp teeth.

[Microscopic view of a fibre of beaver fur.]

When a heap of such fibres is rubbed and pressed, and the fibres made to curl slightly by the action of warmth and moisture, they twist around each other, and the teeth interlace so tightly as not to separate. So complete, indeed, is the entanglement of fibres thus produced, that a coat made from cloth manufactured solely by the felting process has been known to last in wear ten years.

The purpose which the serrated structure of hair or fur is intended to answer is matter for conjecture. With respect to the double fur of such animals as the beaver, the following opinion has been offered: that, as the beaver passes much of its time in the water, the little projections from the filaments of the inner fur may serve as receptacles whereby the water is prevented from reaching the skin, and that the outer fibres may perhaps act like valves, which, when closed, shield the animal from cold, and when open permit the evaporation of water from the inner fur, and likewise permit respiration to go on from the pores of the skin.

But whatever be the purpose which these arrangements answer in the animal economy, it is evident that the minute serrations on the fibres of fur and wool are the means of the felting: this being understood,

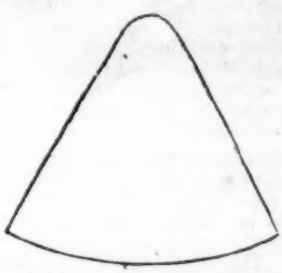
we shall be able to comprehend how the fur and wool are worked up into the form of a hat, and we therefore return to the 'bowing' room. The bowed materials for one hat are divided into two portions, each of which is separately pressed with a light wicker frame, and afterwards with a piece of oil-cloth or leather, called a 'hardening-skin,' until, by the pressure of the hands backwards and forwards all over the skin, the fibres are brought closer together, the points of contact multiplied, the serrations made to link together, and a slightly coherent fabric formed. These two halves, or 'batts,' are then formed into a hollow cap by a singular contrivance. One of the 'batts,' nearly triangular in shape, and measuring about half a yard in each direction, being laid flat, a triangular piece of paper, smaller in size than the batt, is laid upon it, and the edges of the batt, being folded over the paper, meet at the upper surface, and thus form a complete envelope to the paper. The two meeting edges are soon made to combine by gentle pressure and friction, and the other batt is laid over the first in a similar way, but having the meeting edges on the opposite side of the paper. The doubled layer, with the enclosed paper, are then folded up in a damp cloth and worked by hand; the workman pressing and bending, rolling and unrolling, until the fibres of the inner layer have incorporated with those of the outer. It is evident that, were there not a piece of paper interposed, the whole of the fibres would be worked together into a mass by the opposite sides felting together; but the paper maintains a vacancy within, and when withdrawn at the edge which is to form the opening of the cap, it leaves the felted material in such a form as to constitute, when stretched open, a hollow cone.

Our visit to this part of the factory has been somewhat lengthy; but the process of transforming the 'bowed' materials into a conical cap is so important, as illustrative of felting, that if this be clearly understood, all that follows will be tolerably plain.

Few 'kettles' are the scene of such busy operations as the hatter's 'kettle,' and few would be so uninviting to a person fastidious as to cleanliness. Imagine a large kettle or boiler open at the top, having a fire beneath it, and eight planks ascending obliquely from the margin, so as to form a sort of octagonal workbench, five or six feet in diameter, at which eight men may work. The planks are made of lead near the kettle, and of mahogany at the outer part, and at each plank a workman operates on a conical cap, until the process of felting or 'planking' is completed. The 'kettle' contains hot water slightly acidulated with sulphuric acid; and, as far as words can do so, the following may convey an idea of the process:—The cap is dipped into the hot liquor; laid on one of the planks, and subjected to a long felting process: it is rolled and unrolled, twisted, pressed, and rubbed with a piece of leather or wood tied to the palm of the workman's hand, and rolled with a rolling-pin. (p. 41.) From time to time the cap is examined, to ascertain whether the thickness of the material is sufficient in every part; and if any defective places appear, they are wetted with a brush dipped in the hot liquor, and a few additional fibres are worked in. Considerable skill is required in order to preserve such an additional thickness of material at one part as shall suffice for the brim of the hat. When this felting process has been continued for about two hours, it is found that the heat, moisture, pressure, and friction have reduced the cap to one half of its former dimensions, the thickness being increased in a proportionate degree.

In many parts of the factory are 'stoving' rooms, in which, by the judicious arrangement of flues, a high temperature is maintained. To such a room the felted or 'planked' cap is taken, and, when dried, it presents the appearance of a fine, stout, and very strong kerseymere, having a drab or greyish colour. There can be little doubt that such a fabric is well calculated to serve the purposes of common broad-cloth, provided the means of manufacturing it of large dimensions were ensured; indeed a company is now established for this purpose.

Is not the reader still puzzled to know how or when the hat will make its appearance? We have described numerous materials, and have visited many departments of the factory, but have still produced only a drab-coloured, flexible, conical cap, about fifteen inches wide and fourteen high, and without a particle of beaver on its surface. The surface, colour, and form are, however, now about to be changed, in the order here indicated.



In the first place, the cap is taken to the 'waterproofing' room, where the odour of gums, resins, and spirits gives some intimation of the materials employed. Gum-lac, gum-sandrach, gum-mastic, resin, frankincense, copal, caoutchouc, spirits of wine, and spirits of turpentine, are the ingredients (all of a very inflammable nature) of which the water-proofing composition is made. This is laid on the cap by means of a brush, and the workman exercises his skill in regulating the quantity at different parts, since the strength of the future brim and crown depends much on this process.

After another 'stoving,' by which the spirit is evaporated, the exterior of the cap is scoured with a weak alkali, to remove a portion of the gummy coating, and thereby enable the beaver fur afterwards to cling to the woolly fibres of the cap.

Now, for the first time, we have to direct our attention to the fine beaver fur, the purchase and preparation of which are so costly. The washing, plucking, cropping, and blowing departments we have already visited, and have seen the fibres of fur divided into two qualities, of which the finer is that to which the hatter attaches value. This finer quality, which appears to have been formerly known by the name of 'flix,' was, in bygone times, used not only for hats, but also for hosiery purposes, in allusion to which Dyer, in his poem of the 'Fleece,' has these lines:—

> "The beaver's flix
> Gives kindliest warmth to weak enervate limbs,
> When the pale blood slow rises through the veins."

The fur, being bowed very carefully by a smaller bow than that employed for wool, is spread out into a layer, and by means of the 'hardening-skin' is pressed and worked into a very delicate and light felt, just coherent enough to hold together. This layer, which is called a 'ruffing,' or 'roughing,' is a little larger than the cap body; and, to unite the two, another visit to the 'kettle' is necessary. The cap being softened by submersion in the hot liquor, the 'ruffing' is laid on it, and patted down with a wet brush, a narrow strip of beaver being laid round the inside of the cap, to form the underside of the future brim. The beavered cap is then wrapped in a woollen cloth, submersed frequently in the hot liquor, and rolled on the plank for the space

of two hours. The effect of this rubbing and rolling is very curious, and may be illustrated in a simple manner:—if a few fibres of beaver fur be laid on a piece

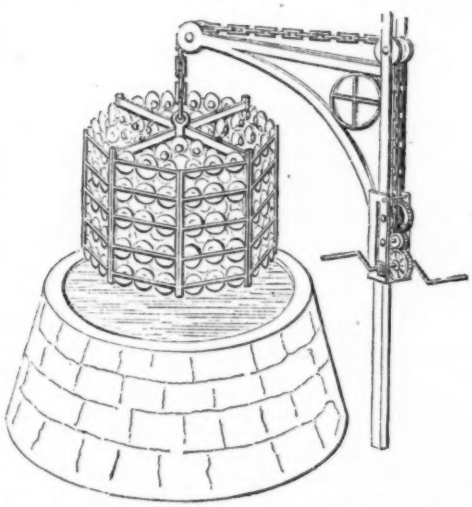
of broad-cloth, covered with tissue-paper, and rubbed gently with the finger, they will penetrate through the cloth and appear at the opposite side. So, likewise, in the process of 'ruffing,' each fibre of fur is set in motion from root to point, and enters the substance of the felt cap. The hairs proceed in a pretty straight course, and just enter the felt, with the substance of which they form an intimate union. But if the rolling and pressing were continued too long, the hairs would actually pass through the felt, and be seen on the inside instead of the out; the workman, therefore, exercises his judgment in continuing the process only so long as is sufficient to secure the hairs in the felt firm enough to bear the action of the hat-brush in after-days. Eighty or a hundred years ago, when beaver fur was cheap, an "old English gentleman" was wont to have his hat so well beavered, that as much nap felted through it to the inside as remained on the exterior; and when the hat showed symptoms of decay and old age, it was sent to the maker, who turned it inside out, and gave it nearly the pristine freshness of a newly-made hat.

At length the cap is to assume somewhat the shape of a hat, before it finally leaves the 'kettle.' The

workman first turns up the edge of the cap to the depth of about an inch and a half; and then draws the peak of the cap back through the centre or axis, so far as not to take out the first fold, but to produce an inner fold of the same depth. The point being turned back again, produces a third fold; and thus the workman proceeds, till the whole has acquired the appearance of a flattish circular piece, consisting of a number of concentric folds or rings, with the peak in the centre. This is laid on the 'plank,' where the workman, keeping the substance hot and wet, pulls, presses, and rubs the centre until he has formed a smooth flat portion equal to the intended crown of the hat. He then takes a cylindrical block, on the flat end of which he applies the flattened central portion of the felt; and by forcing a string down the curved sides of the block, he causes the surrounding portion of the felt to assume the figure of the block. The part which is to form the brim now appears as a puckered appendage round the edge of the hat; but this puckered edge is soon brought to a tolerably flat shape by pulling and pressing.

We here terminate our visit to the 'blocking-shop.' The conical cap has been converted into a hat with a flat brim; and we take leave of the 'kettle,' with its hot acid liquor, its wet planks, its clouds of steam, and its ingenious attendants. We will suppose the hat to have been dried in a stoving-room near the great chimney, and will then place it in the hands of the 'shearer.' In an appropriate room, this workman raises and opens the nap of the hats, by means of a peculiar sort of comb; and then shears the hairs to any required length. Connoisseurs in these matters are learned as to the respective merits of 'short naps' and 'long naps;' and by the shearer's dexterity these are regulated. The visitor recognises nothing difficult in this operation; yet years of practice are necessary for the attainment of skill therein; since the workman determines the length of the nap by the peculiar position in which the long light shears are held. A nap or pile as fine as that of velvet can be produced by this operation.

The routine of processes now requires that we should visit the western range of buildings, on the opposite side of Bermondsey Street. At the remote end of the court-yard we see a dark and dismal-looking building, having very little light, and that little received through unglazed windows,—large boiling

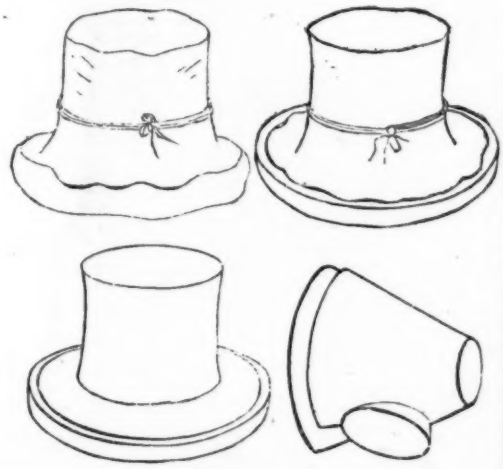


cauldrons, which it requires some nerve to look into,—a spacious brass cage or frame,—cranes and tackle for raising weights,—and a party of workmen whose persons and garments denote the staining effect of the hot dye to which they are exposed. This is the 'dye-house,' where the hats exchange their drab or grey

hue for a black one. The dyeing ingredients are logwood and some metallic salts, boiled in certain proportions in soft water. The logwood is imported from Campeachy in logs five or six feet long, and from five to ten inches thick; and a room in this extensive factory is appropriated to the cutting of these logs into fine shreds. For this purpose a powerful revolving wheel, provided with four cutting-blades inserted radially in one of its faces, is employed: the ends of the logs being applied to these blades, the wood is cut into shreds with astonishing force and quickness.

The cauldron with the dyeing ingredients being ready, a number of hats are fixed upon blocks, and the blocks, by means of a hole at one end of each, are fixed to brass pegs inserted in a large skeleton frame; so that the hats shall not touch each other. The frame is then lowered into the cauldron, and turned in such a manner as to allow all the hats to be submerged in the dye; after which the frame is hauled up, and the hats allowed to drain for thirty or forty minutes. This alternate submersion and partial drying is repeated twelve or fifteen times, until every fibre of the hat,—felt as well as nap,—is thoroughly dyed. This is followed by soaking and washing, which frees the surface from impurities; and the hat is then again 'stoved.' A few subsequent processes remove certain irregularities of shape, which the hat has acquired by repeated submersions in the dye-liquor.

We next visit a department of the building where 'finishers' are employed. A boiler is so arranged as to yield a jet of steam, over which the hat is held until thoroughly softened; and having a block shaped in every part nearly as the hat is intended to be, the 'finisher' pulls, rubs, and presses the hat, until it assumes the form of the block; after which the nap is stretched, turned in any required direction, and smoothed, by various sets of brushes, small cushions of velvet, and heated irons. The adjoining cuts show three successive stages in the shaping of the hats, from the first rough 'blocking' to the production of a flat and smooth-edged brim while on the finishing-block; likewise a beaver bonnet on the block by which it is shaped.



Once again we cross to the east range, and visit the first story of a large pile of buildings on the left hand. Here the busy hum of lively voices soon indicates to the visitor the sex of the inmates. We enter a large square room, full of litter and bustle, and find fifty or sixty young females employed in 'trimming' hats, that is, putting on the lining, the leather, the binding, &c. Some are sitting at long tables,—some standing,—others seated round a fire, with their work in their laps; but all plying the industrious needle, and earning an honourable subsistence.

A word or two respecting the employment of females in factories:—The texture of English society is such, that the number of reputable employments for females in the middle and humble ranks is very small. Most fathers and brothers are well aware of this; and women themselves, however desirous of contributing to their means of support, are cramped in their efforts by the limited range of avocations left open to them. The effect of this is such as never fails to result when the vineyard is too small for the labourers; the number of employments being few, so many females embark in them that the supply greatly exceeds the demand, and the value of female labour is thereby brought to a very low level. Under such circumstances it is important to inquire how far female labour may be available in factories where the subdivision of employments is carried out on a complete scale; and the factory now under consideration may afford some valuable hints on this point. The number of females employed here is not far short of two hundred, whose earnings vary from eight to fourteen shillings per week. The degree of ingenuity required varies considerably, so as to give scope for different degrees of talent. Among the processes by which a beaver hat is produced, women and girls are employed in the following:—plucking the beaver skins; cropping off the fur; sorting various kinds of wool; plucking and cutting rabbit's wool; shearing the nap of the blocked hat (in some cases); picking out defective fibres of fur; and trimming. Other departments of the factory, unconnected with the manufacture of beaver hats, also give employment to numerous females. Where a uniform system of supervision and of kindness on the part of the proprietors is acted on, no unfavourable effects are to be feared from such an employment of females in a factory. We cannot dwell longer on this matter; but in endeavouring to solve the important problem, "How can all live—and live honestly?" the nature and extent of female employments becomes a prominent subject for thought.

But we have not yet finished our hat. However carefully the process of 'blowing' may be performed, in order to separate the coarse fibres of the fur from the more delicate, there are always a few of the former left mingled with the latter; and these are worked up during the whole of the subsequent processes. Women are employed, therefore, after the hats have left the 'finishers,' in picking out, with small tweezers, such defective fibres as may present themselves at the surface of the hats.

Lastly, the hat is placed in the hands of a workman whose employment requires an accurate eye, and a fertile taste in matters of shape and form: this is the 'shaper.' He has to study the style and fashion of the day, as well as the wishes of individual purchasers, by giving to the brim of the hat such curvatures in various directions as may be needed. Simple as this may appear, the workman who possesses the requisite skill can command a high rate of wages. Fortunate is the 'shaper' who during a ramble to any place of fashionable resort can espy a new form of brim,—a curl here, a depression there,—and can imitate it at his workbench,—he will please his employer, and profit himself.

Thus we arrive at the finished state of the beaver hat; and may now leave it to run its career through all weathers,—wet and dry,—cold and heat,—till it is destined to be replaced by a new one. Whether we are contented with the "shocking bad hat," or have to en-

dure the uneasy pressure of the stiff and glossy new one with fortitude, we must assuredly acknowledge that a beaver hat, whether considered with reference to the peculiar processes by which it is produced, or to the number of distinct sets of work-people (from twenty to twenty-five) through whose hands it passes, occupies an interesting and important place in the manufacturing history of this country.

In tracing the progress of a beaver hat, from the time when the materials are brought into the factory, till the hat is made, trimmed, and shaped, we have carried the reader through the greater part of this large establishment, and have shown the purposes to which the different departments are appropriated. It will, however, be desirable to say a few words respecting the silk-hat department.

As the number of beavers caught annually in America has greatly declined, the price of beaver-fur has of late years increased; and this circumstance has led to the production of a kind of hat which presents some resemblance to beaver, and yet may be produced at a low rate. This is the *silk* hat, the manufacture of which has gone through several stages of improvement, by which even an humble 'gossamer' now presents a neat and glossy exterior.

Silk is wholly incapable of the process of felting, and therefore cannot be employed in the same manner as fur and wool. The body of the silk hat is made either of coarse felted wool, or of some light material such as willow or stiffened cambric; and on this is placed a covering or hood of silk plush, sewn to the proper size for the hat. The Messrs. Christy weave their own plush at a factory in Lancashire, and send it to London in the form of a soft glossy material, which is cut and sewn by women to the requisite shape of the hats.

The bodies are made in a very rough way, by shaping the willow, cotton, or felted wool round blocks, and using a substance of extra thickness for the brim. A varnish cement is used to join the various parts; and a resinous stiffening composition is laid over the outer surface. Some time before the plush hood is laid on, the body is coated with a peculiar varnish, which, being softened by a heated iron after the hood is laid in its proper position, causes the plush to adhere to the foundation. This process is the most difficult in the silk-hat manufacture; for not only must the plush be made to adhere in every part, but the seam or joining up the side of the hat must be made as little visible as possible. No sewing is here employed; but the two meeting edges are brought precisely together, pressed down with a heated iron, and the silk shag brushed over the joint.

The minuter details of the silk-hat department we must pass over; for, so far as they differ from beaver hatting, they are of much less interest. Beaver hatters look down with some little scorn on the operations of silk hatting; and certainly, so far as regards manipulative skill acquired by long practice, the former branch of handicraft is by far the most remarkable; but still the silk hatter appeals with such moderation to the purse of the purchaser, that we cannot afford to lose sight of him.

The silk hatters, instead of occupying different parts of the factory, are congregated in one building along the southern side of the avenue leading to the great chimney; the building being divided into numerous small apartments. On the left of the chimney is a range of shops wherein are made common black glazed japan hats, such as are worn by sailors and persons much exposed to the weather. The bodies of these hats are made of common felted wool, and the outer covering is a thick coating of black varnish or japan, presenting a glossy surface. A high temperature is required for this purpose, and the situation and arrangement of the shops are such as to ensure this temperature.

There is a distinct range of apartments in which seal-skin and other skin or fur caps are made. In these, unlike beaver hats, the fur is not cut from the pelt and then felted; but the pelt, with the fur remaining on it, is dressed into leather, and is cut up into such pieces as may, by subsequent processes, be formed into caps of various shapes.

Another department, entirely distinct from the rest, is that in which cloth caps of various kinds are made. This, generally speaking, is effected by needlework, and wholly differs from the processes of hat-making.

Here we terminate our visit to an establishment which presents so considerable a number of interesting processes. We have selected that of Messrs. Christy because, from the completeness and systematic arrangement of the details, it well illustrates the economy of a large factory,—the concentration of many departments within the walls of one establishment, the division of labour, the exercise of delegated authority by foremen to each department, and a general supervision of the whole by the proprietors. It is difficult to estimate the area of ground covered by all the workshops; but the reader may, from the foregoing details, form some idea of the numerous piles of building constituting the factory. There are many establishments in and near London, such as water-works, gas-works, ship-yards, tan-yards, brewhouses, distilleries, glass-works, &c., the extent of which would excite no little surprise in those who for the first time visited them. Indeed the densely packed masses of building forming the eastern districts of the metropolis, on both sides of the river, include individual establishments which, although they would appear like little towns if isolated, scarcely meet the eye of a passenger through the crowded streets.

We may here remark, as a completion of our notice of the hat manufacture generally, that the making of straw-hats, so much worn in country places, is in the hands of a class of persons altogether different from those engaged in the other branches of hatting. The finer qualities of straw, as well as white whalebone and white chip, are used for bonnets rather than for hats; but the mode of manufacture is nearly the same in all. There are delicate planing-machines in use, by which any soft kind of wood can be cut into thin shavings, and the shavings, at the same time, cut into very narrow strips with great precision. Such is the case with willow, and also with whalebone. The willow of which the foundations of silk hats are frequently made is prepared in some such way as this; the narrow strips of willow being plaited, or perhaps we might say woven, into a square sheet sufficiently large for three hats. A slight glance at the willow foundation of a silk hat will show the nature of the material, and will also show that the mode in which the narrow strips are linked together resembles weaving rather than plaiting. It is not difficult to imagine, from these few details, that a hat or bonnet may be made from any such materials as whalebone, wood, straw, cane, rush, or others wherein a longitudinal fibrous structure is found; and the reader will readily call to mind numerous examples of such an application of fibrous materials.

In conclusion, we have to acknowledge the courtesy of the proprietors, and to express our pleasure at the harmonious and kindly feeling which evidently exists at this factory between the employers and the employed. The maintenance of such a feeling between parties thus connected is of the highest importance in a manufacturing country like England, and forms one of the most valuable ties in the structure of society.